

Dr. Peterson

Clean Energy Manufacturing Institute Keynote Speech

9 a.m. Thursday, July 9, 2015, Renaissance Atlanta Midtown Hotel

Thank you, Assistant Secretary Danielson, for that kind introduction and for your leadership at DoE. Please allow me to add my sincere welcome to all of you. We're glad you're here with us in Atlanta and hope that during the Summit today, you'll learn about the important work of the CEMI and how it can help you; that you'll be inspired by innovation in clean energy, manufacturing and technology; and that you'll have the opportunity to network with other leaders in the Southeast.

By the end of the day, we think you'll have a clear picture of how the Southeast is making a real impact nationally and internationally in the field of clean-energy manufacturing. This morning, I'd also like to share some of the exciting things Georgia Tech is doing in collaboration with other energy players and take a look at what the future might hold.

The Southeast is on the cutting edge of advanced manufacturing in our country, and in a minute, we'll talk about some of the great things going on in our region in the clean-energy arena. We're very pleased that you will have the opportunity today to discuss how we can work more closely together to grow, sustain and keep clean-energy manufacturing jobs in our country.

To give you an idea of the economic punch the Southeast has, our region's \$3.7 trillion GDP (gross domestic product) would put us fourth among the world's nations behind only the U.S., China, and Japan.

In the coming decades, we will see massive investments in clean new power-generating capacity throughout the world. The U.S. Energy Information Administration projects that roughly 60% of new power-generation capacity between now and 2035 will be supplied by gas turbines, which adds up to approximately \$250 billion in the

U.S. and \$1.1 trillion worldwide.

Aerospace, automotive, and power-generation sectors are rapidly expanding their footprints in the Southeast.

We have seen a recent convergence of major gas-turbine manufacturing facilities and energy jobs coming to the region. This trend started a decade ago, but it has accelerated with several key players coming together into a regional hub just in the past few years:

- Siemens put in an engineering and manufacturing facility in Charlotte in 2011, where it has developed a \$130 million manufacturing operation. Siemens has also had a major engineering operation with 1,800 employees headquartered in Orlando since 2002.
- In 2011, Mitsubishi, based in Tokyo, located a facility near Savannah, where it has installed a \$325 million manufacturing facility.
- Alstom, a French-based company, made a big investment in Chattanooga in 2010, recently completing a \$300 million manufacturing facility.
- GE Energy established its headquarters in Atlanta in 1998, and Greenville, South Carolina, is the home of the world's largest gas-turbine manufacturing plant, with over 3,000 employees.

Ten major aeronautical companies are located in five Southeastern states. There are also a significant number of Southeast-region operations in the complementary area of aircraft gas turbines, a market that is slightly larger than that of power-generating gas turbines.

Delta Tech Ops is the largest such operation. It is located adjacent to Hartsfield-Jackson Atlanta International Airport, and its repair and overhaul business is a \$600

million operation. In addition, various facilities associated with GE Aircraft Engines and Pratt & Whitney, as well as various tier-two suppliers, are located in the region.

Georgia Tech has major strengths in the gas-turbine arena in four of the University's strategic research themes: energy, manufacturing, materials, and systems. We have well-developed relationships with several major Original Equipment Manufacturers (OEMs) and operators of power-generating and aircraft gas turbines, including General Electric, Siemens, Mitsubishi, Pratt & Whitney, Delta Air Lines, The Southern Company, and others.

By the energy-intensive nature of their business, automobile manufacturers are also key players in the clean-energy field. Fourteen auto manufacturers are located in the Southeast — four in Kentucky, three each in Alabama and Tennessee, two in Mississippi, and one each in Georgia and South Carolina.

Technical research universities like Georgia Tech are positioned to be significant players as we as a country figure out how to make clean-energy production and distribution an integral part of our industrial efforts. U.S. manufacturers have a huge and growing demand for skilled production workers, engineers and technicians. The resurgence in U.S. manufacturing since 2010 has already led to more than 600,000 additional jobs. The National Association of Manufacturers estimates that more than two-thirds of their sector's current skilled workforce will have retired by 2030.

These demands translate into higher pay for manufacturing workers. During the past decade, new hires in manufacturing earned an average of 38 percent more than new hires in non-manufacturing industries. And over a career, a manufacturing worker earns 17 percent more in wages and benefits than his or her counterpart in other sectors, according to U.S. Commerce Department data.

Together these trends indicate a major opportunity for the next generation of workers. Georgia Tech is doing its part to support good jobs in this industry, which is crucial to U.S. competitiveness. Government, industry and academia are joining forces like never before to ensure that U.S. manufacturing continues to grow. It is vital that we do that as a country, both for the individuals who will contribute so much to society's fabric and their own families, and also for the economy we will build as we head deeper into the 21st century.

The Commerce Department and Georgia Tech are part of the Advanced Manufacturing Partnership, a public-private collaboration dedicated ensuring that the United States remains the most desirable place to make sophisticated products. One of the partnership's recommendations was to create the National Network for Manufacturing Innovation. This growing network of regional manufacturing hubs will ensure that most important technological and commercial breakthroughs take place in America and benefit American workers.

As a member of the President's Advanced Manufacturing Partnership Steering Committee (twice), I am proud of the work produced by both AMP initiatives, especially the creation of a National Network for Manufacturing Innovation, an initiative launched by President Obama in 2012. I would also like to extend thanks to Assistant Secretary David Danielson for his continued support of these manufacturing institutes and for his recognition of the value they bring to the future of American manufacturing.

We're also proud that Rafael Bras, our provost and executive vice president of academic affairs at Georgia Tech, has for the past two years been a member of the Secretary of Energy Advisory Board. It's a 19-member panel made up of scientists, business executives, academics and former government officials, and it serves as an independent advisory committee to Energy Secretary Ernest Moniz.

Georgia Tech has been a strong contributor to the national agenda in manufacturing innovation. We participate in two manufacturing organizations under the President's National Network for Manufacturing Innovation — (1) the Digital Manufacturing & Design-Innovation Institute (DMDII) and (2) America Makes.

America Makes is the national accelerator for additive manufacturing (AM) and 3D printing (3DP). It is the nation's foremost collaborative partner in AM and 3DP technology research, discovery, creation, and innovation. America Makes works as a public-private partnership with member organizations from industry, academia, government, non-government agencies, and workforce and economic development resources to increase the nation's global manufacturing competitiveness. Georgia Tech recently joined the America Makes Institute as a Silver Level Member.

We are represented on the Strategic Planning Committee, which is developing a long-term strategy for the DMDII. We also participate on the DMDII Technical Advisory Committee, which identifies critical technology areas in which to invest. We are also part of the DMDII management team through its Executive Committee. Finally, we are heavily invested in DMDII's Workforce Development Advisory Committee, which is working to maintain the trained workforce necessary to keep the U.S. in its leadership role in advanced manufacturing.

Georgia Tech has also enjoyed a fruitful partnership with ARPA-E, the Advanced Research Projects Agency-Energy. ARPA-E advances high-potential, high-impact energy technologies that are too early for private-sector investment. ARPA-E awardees are unique because they are developing entirely new ways to generate, store, and use energy. Since 2009, ARPA-E has funded more than 400 potentially transformational energy technology projects, 10 of which have been led by researchers at Georgia Tech. Four projects are underway right now at Georgia Tech. We're working on:

- (1) A high-efficiency solar-fuel reactor
- (2) Graphene-based supercapacitors
- (3) Power generation using solar-heated ground air; and
- (4) A fuel cell tailored for efficient utilization of methane.

In an ARPA-E project that was completed about a year ago, Georgia Tech's design innovations created an absorption heat pump that is much smaller than conventional heat pumps, has higher energy efficiency, and can also be mass produced at a lower cost and assembly time.

In addition, Georgia Tech was recently awarded a new DOE grant that will focus specifically on developing new clean-combustion technologies that are being enabled by the deployment of advanced manufacturing. In other words, the idea of this project is to fundamentally rethink what these systems should look like, starting from a “clean sheet of paper.”

Georgia Tech also has major initiatives in Cybersecurity and Big Data Sciences, which have strong energy application. For example, Georgia Tech has a DOE project that is looking at concepts for future, intrinsically secure, distributed electricity grids. We are also working closely with a number of our industry partners on applying big-data methods for optimizing energy-system fleet performance and minimizing expensive failures and downtime.

One of your breakout sessions this afternoon will be about workforce development. A core belief we have at Georgia Tech is that you can't wait until students are deciding on which college to attend to get them excited about science, technology, engineering and math, or STEM. We are working to get young people excited about STEM as early

as possible. Good writing and design are important too. So much of learning in the modern university is collaborative and interdisciplinary. We have outreach units within the university that offer young people opportunities to participate in everything from science fairs to robotics competitions to invention competitions that help to inspire the innovator within each of them.

Each summer, for example, a number of high school students join Georgia Tech students in the Invention Studio for Makers Camp, building devices like a quad-copter, a simple helicopter that actually flies. Many times that's just the spark they need to explore one of the exciting career opportunities in manufacturing.

Not all of them will end up in clean-energy careers, but it's a much shorter leap if we get them excited about devising technological solutions to problems at a young age. We need to get the word out.

Helping educate the public about the promising career opportunities is important to me. In fact, last year I co-authored an op-ed piece with U.S. Commerce Secretary Penny Pritzker that appeared in the *U.S. News & World Report*. It was an open letter to parents encouraging them to steer their children toward a manufacturing career. We attempted to debunk the old image conjured up by the word "manufacturing" as the image of an untidy factory floor full of dirty, dangerous and repetitive jobs.

As we wrote then, and I hope you don't mind my quoting, "many manufacturing facilities in the United States today are cleaner than most offices or doctors' office waiting rooms. They are gleaming showrooms of the latest technologies. And they are staffed by highly skilled and well-educated professionals producing the most exciting breakthroughs of our time."

Once students arrive at Georgia Tech, they find that energy education is woven throughout our curriculum. In late June, the U.S. Department of Energy announced a \$200,000 grant to Georgia Tech that will support 20 student project teams in developing building energy-efficiency technologies through a capstone design project.

Our students will gain hands-on product design experience, including the manufacturing and testing of a prototype solution, as well as publically demonstrating the solution at our Capstone Design Expo. Student teams partner with company sponsors, which fosters student employment in the building energy-efficiency sector. We also have several initiatives that help those interested in improving their grasp of energy-related issues:

Energy Seminar Series

Monthly seminar series for Georgia Tech faculty and local businesses, focused on fostering our clean-energy ecosystem

Massive Open Online Course (MOOC): Energy 101

- More than 30,000 people worldwide have been enrolled in the course

Energy for Staffers

- Adapted from the successful the Energy 101 format
- Provides policy makers with technical knowledge needed to make informed policy decisions.

Executive Lecture Series

- Workshops connect the energy research community both within and outside of Georgia Tech for discussion around topical issues.

Energy Club

- Ours is one of the largest student-led energy clubs in the country. It's something that is near and dear to Assistant Secretary Danielson's heart. I'm told that he founded the student energy club at MIT when he was a student there. The Energy Club promotes interaction, discussion, exchange of innovative ideas, and networking.

Georgia Tech is one of the Southeast's epicenters in clean-energy efforts, and I'll share some of the things that are going on both on our campus and throughout the state with the help of Georgia Tech people.

We have strong collaborations with a wide range of companies, many of which have located corporate innovation centers at Tech Square on our campus to better collaborate with Georgia Tech innovators.

The Georgia Tech Strategic Energy Institute serves as a conduit for integrating, facilitating, and enabling Institute-wide programs in energy research and development. We engage the best and brightest from industry, government, and academia in partnerships to create innovative solutions to current and future energy challenges. In recent years, the SEI has had master agreements with several notable industry partners, including:

- Siemens
- General Electric
- Exxon Mobil

We also have a knack for commercialization of energy-related startups. Some examples of businesses that have gotten their start on our campus:

- **Suniva**, maker of high-efficiency monocrystalline solar cells and headquartered in Norcross, Georgia. Suniva grew out of a long-term investment by DoE in our Center of Excellence in Photovoltaics.
- **Climate Forecast Applications Network (CFAN)**, Hurricane and tropical storm and wind energy forecasting
- **Plum Combustion**, low-emissions combustion technology
- **Urjanet**, energy data collection and normalization
- **ViaCycle**, Bicycle sharing technology and services
- **RideCell**, Automated fleet management

We are focused on trying to be an even better partner with both government and industry. We want to enhance our role as an anchor institution and to help our non-university regional partners focus on growing our own manufacturers through better scale-up processes and the growth of an innovation ecosystem growing outward from Atlanta.

One way we do that is by working through our Enterprise Innovation Institute (EI²) to help grow existing manufacturers through programs such as the Georgia Manufacturing Extension Partnership (GaMEP), Minority Business Development Agency (MBDA), and Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) assistance.

All told, Georgia Tech's innovation neighborhood efforts through EI² have resulted in big dividends to Georgia. In fiscal year 2014, EI²'s state and federally funded manufacturing program helped 1,440 companies in the state increase sales by \$219 million, create or save almost 2,000 jobs, and cut costs by \$40 million. EI²'s government procurement program helped Georgia companies secure \$592 million in government contracts and create or save an estimated 11,850 jobs.

VentureLab, a Georgia Tech incubator at Tech Square that serves faculty, staff, and students, is another key component of the innovation neighborhood. It is designed to bring research and ideas from Georgia Tech to market. To date, VentureLab has helped Georgia Tech instructors, staff, and students develop more than 300 startups and form companies based upon their research. It was recently named the No. 2 university-based incubator in the United States.

Georgia Tech is a leader in nanotechnology research, which studies the manipulation of matter on an atomic, molecular, and supramolecular scale. Government and private industry together invest more than \$3 billion per year in nanotechnology R&D in the U.S., and globally the total is much higher.

Our researchers are working to understand the impacts of nanotechnologies on green economic development in such areas as energy, the environment and safe drinking water. Because nanotechnology commercialization is still in its early phases, our experts are trying to get a better sense of what markets will grow and how new nanotechnology products will impact sustainability.

Nanotechnology underlies many different industries, so forecasting its impact won't be easy. To make those judgments, we'll have to balance gains in efficiency and performance against the net energy, environmental, carbon and other costs associated with the production, use and end-of-life disposal or recycling of nanotechnology products. There seems to be some potential as a prism through which to view clean-energy issues.

Vehicle lightweighting for energy efficiency is also an area that holds much promise. The Southeast's aerospace- and automotive-materials supply chains, with Georgia Tech's support, are invested as part of the lightweighting ecosystem. Through

lightweighting, we can reduce the weight of a product, component, or system to enhance (1) performance capability, (2) operational supportability, and (3) survivability.

Novelis is an international aluminum-rolling company with sales offices and production sites in 11 countries on four continents. It is deeply involved in lightweighting. The Novelis global headquarters are in Atlanta, and it's got a Global Research & Technology Center just north of here in Kennesaw, Georgia.

Georgia Tech has partnered with Novelis in research opportunities, recruitment and internships for the future generation of engineers. And ThyssenKrupp Elevator Americas has located an innovation center at Tech Square, where it experiments with lightweight materials, including advanced high-strength steels.

I should also mention The Southern Company, one of the nation's premier energy-supply companies. Georgia Tech and The Southern Company have partnered on many initiatives over the years, and it recently joined our already strong lineup of innovation centers in Tech Square.

Georgia Tech is the Southeastern regional coordinating institution for the Materials Genome Initiative (MGI). MGI wants to enable the materials science community to design, develop, manufacture, and deploy advanced materials at least twice as fast as possible today and at half the cost.

Our Institute for Materials hosted regional and national MGI workshops in 2014 to promote new types of academic/industry/government stakeholder networks to address the Initiative's objectives. As such, we are vitally interested in working with and supporting technology advances of materials supply-chain companies in the strategic automotive and aerospace sectors.

With the support of the Clean Energy Manufacturing Initiative, it is efforts like these through which the 21st century's great energy challenges will be explored and addressed. Georgia Tech is proud to be part of the great Southeastern clean-energy ecosystem.

I want to thank you again for bringing the CEMI Southeast Regional Summit to Atlanta. You are about to have a great day of learning, and on behalf of Georgia Tech we wish you the best, and hope that you have a safe trip back home.